



Education in the 21st Century

The Second Education Paradigm

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Occasionally in history events conspire together to bring about fundamental change across an entire social landscape. We are presently witnessing one such event; the complete rebuilding of what we understand education to be. The transition to the second education paradigm is changing education forever, and those countries which recognise this opportunity and have the social and political willpower to make the transition will dominate the Knowledge economies of the 21st century. The choice is quite stark: realise the opportunity, invest in it and reap the rewards or pretend that nothing is happening, that change is too difficult and become trapped in an education never-never land and watch as social, economic and Knowledge potential withers and dies. Countries must choose to make the transition and do so knowingly and with a sense of purpose and commitment. Choosing to do nothing is a choice.

Welcome to the dinner party of a lifetime!

Introduction

The claims on which we currently based our secondary schooling, served a world that many of today's adolescents do not wish to aspire to and is not real for so many of them (Steinberg,1996). The problem of engagement will become the greatest problem to face our schools, and this is further underlined when it is recognised that non-engagement is a major adolescent malaise. Engagement is in the hands of excellent teachers and inspiring teaching. John Hattie: The Knowledge Wave Conference in New Zealand 2003
http://www.knowledgewave.org.nz/forum_2003/speeches/Hattie%20J.pdf

The purpose of this article is to provide an overarching framework that describes education in the 21st century, not as it is but rather what it could be. One of the most successful teaching practices is the use of metaphor and in order to provide this overarching framework we have used the metaphor of the dinner party. Our first task is to establish the purpose of a dinner party and from there we can then set about deciding what constitutes a successful menu that would meet the purpose of holding a dinner party.

With the advent of the second education paradigm [http://www.teachers.work.co.nz/archive_Aug_2004.htm] there are many philosophical, managerial and infrastructural issues that need to be addressed and these need to sit within an integrated strategic plan which facilitates consistency within the compulsory teaching and learning environment. The menu for this to be successful is set out below:

The Successful Menu

The purpose of a dinner party is multifaceted. On the one hand it is a social occasion, a reason to bring people together in a single place and enjoy each other's company. On the other hand it is also a time for animated and passionate discussion with people holding wide-ranging views across many different topics and interests. It is also a time when the body receives necessary sustenance (and sometimes more than it needs), and it is also a time where the hosts enjoy to share their home with close friends; "their community", and also to integrate new members into that community.

The wine selection is very important as this will assist in setting the palate for the meal. We would recommend a quite heady and recently bottled vintage, based around the cognitivist and constructivist grape varieties with a strong underpinning of values laden fruits providing a soft but rich and enduring aftertaste.

The entree sets the scene for the rest of the meal and for your enjoyment tonight we have a single "second paradigm" entree which may appear a very simple fare on its own but when we add to it the PD sauce the result is a taste that your palate will never forget.

The main course will provide the essential framework for the remainder of the meal. The main course tonight will be based around an "essential competency pie" which is a departure from the traditional main course of boiled skills which has a tendency to be somewhat dry and leaves a rather bland aftertaste in the mouth following the meal. The main course may take some years to fully digest and we recommend strongly that you do not rush this course and that you enjoy the fresh accompanying "content" vegetables picked from the local garden.

Dessert is a very rich multilayered gateau including a sweet but stable selection of hardware biscotti layers separated with an Ministry/Department of Education advice flavoured liqueur cream topped off with a soft[ware] and enticing meringue. This is accompanied by a light infrastructure fruit salad and served with lashings of interoperability gelato to provide a refreshing compliment to the sweet gateau. There is also a selection of rich ICT sauces that patrons can add to suit their own taste.

Cheese and Port conclude any good meal and these leave a pleasant memory in the mouth. Please ensure that the meal is not overwhelmed with this final course but rather that it compliments and encourages the meal, allowing the patron to leave with a good taste in the mouth and a feeling of having partaken in a successful dinner party. We suggest a mixture of assessment cheeses and a glass of [re]Port[ing] that has matured well, has a rich flavour but carries a softness that does not overwhelm the meal just enjoyed.

The Guest List defines the success or otherwise of the dinner. In the past not everyone was invited to the dinner. Only people who appreciated the finer things in life were invited. For this dinner everyone is invited. If the community of patrons is pleasant, amiable and there is a consistent focus on the purpose of the dinner, then dinner can be an enjoyable time, not rushed, but with each course savoured and enjoyed for its own sake, but at the same time each course contributing to the overall sense of a satisfying meal. A successful dinner should be punctuated by animated and passionate discussion with a wide variety of views expressed but at the conclusion of the meal each patron goes away having contributed to the discussion, they have felt listened to, and so can depart with a warm afterglow that transforms a mere dinner into a sumptuous banquet with everyone looking forward to the next time they meet.

An After-Dinner Mint provides a fresh and alive flavour in the mouth. The purpose of the mint is not for sustenance but rather to refresh and inspire; it is small but it is the taste you leave the dinner with.

"But, alas, none of these achievements makes us better men. There is no equation between bank accounts and goodness of heart. Knowledge is by no means the same thing as wisdom or nobility of spirit... The world has never seen before such an immense army of educators at work on the youth of the country, nor has there ever been before in the history of the world, such a generous outlay of money for education, both lower and higher. The total effect, however, is disappointing, and misses the central point. Our institutions of learning produce some good scholars and give a body of scientific facts to a great number. But there is a pitiable failure in the main business of education which is, or should be, the formation of character, the culture of the spirit, the building of the soul."

- Jones, Rufus M., *The Need for a Spiritual Element in Education*, World Unity Magazine, October 1928. [quoted from <http://laluni.helloyou.ws/netnews/bk/intellect/inte1007.html>]

Chapter 1: The Purpose of the Dinner Party

So what is the purpose of having dinner with a group of friends? You could of course have dinner on your own and for that matter the meal could be quite bland and it would still meet all the dietary requirements that your body required, but it would not be a particularly pleasurable and satisfying experience. Get any group of people in the same environment and immediately you have a variety of opinions, ideas, philosophies and personal worldviews of what education should and could be. Being human beings these worldviews are not always as sensible and logical as you may expect.

Martin Luther King in 1947 had this to say in regard to the purpose of education:

"We must remember that intelligence is not enough. Intelligence plus character--that is the goal of true education. The complete education gives one not only power of concentration, but worthy objectives upon which to concentrate. The broad education will, therefore, transmit to one not only the accumulated knowledge of the race but also the accumulated experience of social living."

http://www.stanford.edu/group/King/publications/papers/vol1/470200-The_Purpose_of_Education.htm

Being "intelligent" is all very well, being able to access and use vast information and communication resources is useful, being able to be critically literate is impressive and being able to synthesize and distill new knowledge is powerful but all these traits were shown by a small group of people who flew two planes into two large buildings, killed thousands of people and changed the world forever. The purpose of education must extend beyond this; it must contain an ethical underpinning and promote values that we can aspire to as a community especially as society increasingly take on a more and more non sectarian position for in our every-busy lives where else are our children going to obtain an education in what is right and moral.

As we provide more and more tools and processes which allow for significantly increased knowledge and understanding by each individual increasingly the education system and all its members have a moral responsibility to accompany that knowledge and understanding with a framework of agreed on values and ethics in order to provide our young people with a framework to guide the use of their new found knowledge and understanding.

The purpose of education is an expressed goal; an outcome that we would desire for all citizens, not just children. We could debate forever the purpose of education but in order to be serviceable the defined purpose of education needs to be succinct and inclusive and for that reason we defer to the following purpose:

The purpose of education is to provide each member of society the capability to contribute to the collective goals, (philosophical, idiosyncratic, practical and social), of that society where these goals are based around the accepted values of the community and that those goals and values are based on the historical and cultural wisdom of that community.

As you can see we then get to defining culture, wisdom, what the goals should be and what are acceptable values. If you would like more background reading on this then you may like to read the essay on wisdom written earlier in the year

[\[http://www.teachers.work.co.nz/archive_July_2004.htm\]](http://www.teachers.work.co.nz/archive_July_2004.htm) . Debate on this is very necessary and should not be disregarded as it forms the fundamental notion of what education will be within each community. Therefore by definition it is necessary for the Department/Ministry of Education to ensure that the education system allows for the local, identified values and goals to become embedded in the delivery of what we call "education". In other words education should be flexible and capable of meeting local needs. This of course relies on the acceptance of individuality but at the same time acknowledges that no generic system no

matter how localized will deliver exactly what each individual learner requires at any given point in their learning continuum no matter how carefully we try and meet the local needs.

There was a time when the “use-by date” for knowledge was counted in centuries but now it can figure in days and months, especially for scientific and research based knowledge. That we can potentially know more now than ever before is beyond doubt but access to knowledge and the capability to process, manage and apply it is not equitable. In order to make this socially equitable the essential competencies to build understanding when it is required; the capacity to be a lifelong learner, must be available to all. That is one of the prime functions of the public school system; to ensure that every learner is provided with the same opportunity to make of life what they choose, what or how they choose to do with that potential is an individuals choice but the capability must be available to all. The role of schools is to even the scales and make sure all are using the same judgment weights.

Three hundred years ago the first modern education paradigm was brought into play through the printing press, where knowledge became available to all through the price of books being reduced considerably and the resulting increased accessibility. The first education paradigm enabled everyone to “know”. In the 21stC the second modern education paradigm is emerging where the cost and accessibility of knowledge is such that we are overwhelmed by it; so much so that as educators we can see the potential not just for everyone to “know” but that everyone has the potential to **understand** the world they live in. Suddenly the purpose of the dinner is not just to consume food for survival but rather to appreciate the food, the company and enjoy the event.

The second education paradigm has arrived and it will revolutionise our society, but just as the first education paradigm took time to permeate all levels of society and government this one will too. But the choice to take on the second education paradigm is not linked to a technology (the printing press) that was slow to replicate or to be heard about in far off lands; this technology is here now for all to see but for many the Emperors clothes look just fine.

The Emperor has no clothes!

There are no boundaries, there are no limits and as the Nike© advert say “passion has no volume control” so lets turn up the volume and deliver the second paradigm. The purpose of education has not fundamentally changed but its delivery and its focus has changed forever. The following chapters describe those changes.

Chapter 2: The Wine

There are numerous education philosophies that we could tap into and use but not all are based on the premises underpinning the **first** education paradigm [http://www.teachers.work.co.nz/archive_Aug_2004.htm] so it is important that we select a philosophical model that is in keeping with the emerging second education paradigm. There are numerous teaching strategies and processes and an equally vast number of learning strategies and processes which could be encouraged and be bought into by the teaching fraternity so the overarching philosophy must accommodate an extraordinarily large set of permutations of these teaching and learning toolsets.

Gwen Gawith, in a recent article under the heading "Learning for Meaning" in the journal "Good Teacher" [Term 4 2004 <http://www.ed-media.co.nz/>] presented a quite insightful statement: *"while teachers often shy away from theory, the point I am making becomes a lot clearer if you examine it in the context of theory>pedagogy. In short, the recent marriage between cognitivist and constructivist theory has given rise to a rich pedagogy (the science and art of teaching and learning) which represents research based support for concrete strategies for turning the rhetoric of "teaching for meaning" into the describable, measurable reality of "learning for meaning".*

This marriage between cognitive and constructivist theory has appeared to materialise out of nowhere over the past 10-20 years by flying in "beneath the radar. In this marriage (cogno-constructivist or if you like constructo-cognitivist), the two partners both bring strong theoretical as well as practical based research to the union and in the process provide a powerful overarching philosophical base that could underpin the emerging second paradigm. It should be remembered here that as with any new technology paradigm, such as education (technology: any collection of products, systems and environments that meets the needs or opportunities of a community), as the second paradigm first emerges it is by default inefficient while it puts down its roots and gets established in its new environment. The new environment will either provide the nutrients and resources for growth that are appropriate for the second education paradigm or the emerging paradigm will not receive the nutrients, resources that are specific to its needs and it will wither and die. Initially it may appear to grow well but lacking particular essential nutrients it may never flower and fruit and while looking good it will never replicate itself and never be of any practical use other than looking good unless it receives the political, academic and public goodwill it requires.

Research in neuropsychological brain mapping has come along in leaps and bounds in the last five to 10 years as new technologies such as fMRI [Cognitive Neuroscience: Implications for Education http://www.brookes.ac.uk/schools/education/staffinfo/CWSE_26_1_02lores.pdf] allow us to more accurately peer inside the brain while its human owner carries out a range of tasks. Much of this research is rewriting our fundamental understanding of how the mind works, the nature of consciousness and it is also directing educators as to how they can apply this new understanding to improve classroom teaching and learning practices. As a relatively new area of research it holds the promise of providing us rich quantitative research in regards to learning as well as rewriting previously held anecdotally and predominantly qualitatively based theories.

Teaching students "thinking skills" has become a feature of 21st education practices however most teachers have taken the atomistic approach to thinking skills, teaching the use of individual thinking skills tools rather than overarching thinking process. A common example of this is the teaching of de Bono's Six Thinking Hats programme and having this being presented as if it were teaching "thinking skills". The Six Thinking Hat program is an excellent tool but it is not an overarching view of thinking but rather a particular cognitive tool used in particular situations to develop particular thinking habits. Art Costa and Bena Kallick

have written some considerable work on developing "Habits of Mind" [<http://www.habits-of-mind.net/>] which describes different types of intelligent behaviours (such as assisting, metacognition, questioning, risk-taking, communicating and they refer to these as "habits of mind" but this still does not present a complete overarching view of thinking which teachers can then use and apply as necessary. Four years ago we did a literature review on this topic and over the course of 18 months developed a thinking model that has been adopted by a number of schools which we will briefly outline here.

Defining thinking is a considerable academic challenge but in order to progress this overview we will define thinking as "the process which contributes to the reinforcement or the iterative changes that occur to persons world view". If this is a reasonable definition then we then need to investigate how our world view is built, and how it can be reinforced and modified. This is the fundamental crux that underpins all teaching and learning processes and for this reason it is critical students understand thinking in order that they can reflect on their own thinking processes (metacognition).

Briefly the model [http://www.i-learnt.com/Thinking_What_is_2.html] contains six elements that contribute to a persons continually changing worldview. These intricately intertwined elements are discussed by a wide range of cognitive researchers, from which we have created a simplified flowchart. This flowchart, containing the six elements demonstrates the main interrelationships. The main contributors whose work we have used to develop this flowchart includes Marzano, Vygotsky, de Bono, Swartz, Browne, Papert, Dunlop, Grabinger, Dugoid, Collin, Campione, Brandt, Hughes, Harpaz, Lefstein, Jones, Presseisen, Rankin, Suhor, Bloom, Jonassen, Costa

1. **Initiators of thinking:** needs/wants/desires; imperatives; discourse; reflection (metacognition); mystery/intrigue; observation(s); communication; (oral/written/visual); opportunity; inspiration; high order thinking questions; competition; inflammatory/radical statements; purposeful research; serendipity*; interaction(s)
2. **Thinking Processors:** Creative Thinking; Critical Thinking; Metacognition; Values/Culture/Spirituality; Problem Solving; High Order Thinking Questions
3. **Facilitatory Environments:** Context; Construction; Collaboration; Conversation/Communication; Information . . .
4. **Thinking Skills Processes:** Information Gathering Skills; Generating Skills; Focusing Skills; Remembering Skills; Analysing Skills; Integrating Skills; Evaluation Skills; Organising skills
5. **Facilitatory Tools:** Goal Setting; Brain Storming; Peer Tutoring; Conferencing; Concept Maps; Mind Mapping, Webquests; Microquests; Study Groups; Concept Scaffolding
6. then there's **Human Nature:** This is a selective/irrational and passionate filter which means that even after rational processes are employed, final decisions dismiss the thoughtful processes and unbelievably dumb decisions are made on a reasonably regular basis!

This is a greatly simplified model and as such it should be noted that:

1. All models are fraught with assumptions and simplifications and by their very existence are flawed; BUT they are useful.
2. The way we behave (as a representation of our thinking/thought processes), is very dependent on the cultural setting we find ourselves in. i.e. how we behave in an academic environment, how we behave in our home environment, or on the sports field, are often very different.

3. We are not robots and by our very nature, as human beings, we are passionate, silly people who are fantastically varied and very interesting creatures to study!

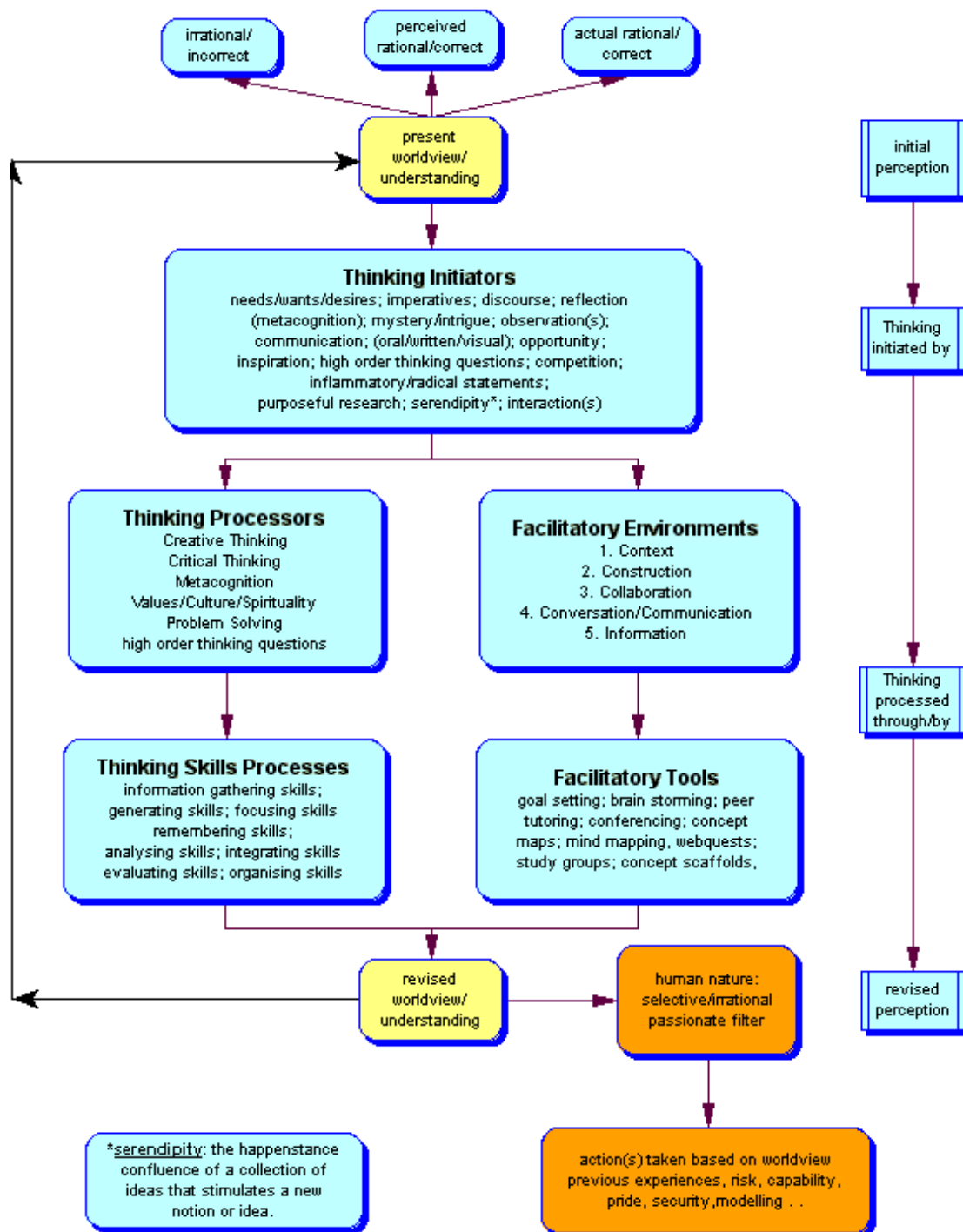


Diagram 1

Teaching & Learning Philosophy: Constructivist theory came to the table in the 70's and 80s but was dogged by attitudes of senior educators that as a concept it was a soft option, applied to justify teachers who could not control student behaviour and where students ran

the classroom in the absence of any structure. Recent refinements and a more disciplined set of parameters surrounding "constructivist theory" have led to a renaissance of "constructivism" but many misunderstandings of the concept still survive.

In an excellent article by Martin Brooks and Jacqueline Grennon-Brooks the two authors identify five central tenets of constructivism [Grennon and Brooks and Brooks, 1993)¹

"The search for understanding motivates students to learn. When students want to know more about an idea, a topic, or an entire discipline, they put more cognitive energy into classroom investigations and discussions and study more on their own. We have identified five central tenets of constructivism"

- *First, constructivist teachers seek and value students' points of view. Knowing what students think about concepts helps teachers formulate classroom lessons and differentiate instruction on the basis of students' needs and interests.*
- *Second, constructivist teachers structure lessons to challenge students' suppositions. All students, whether they are 6 or 16 or 60, come to the classroom with life experiences that shape their views about how their worlds work. When educators permit students to construct knowledge that challenges their current suppositions, learning occurs. Only through asking students what they think they know and why they think they know it are we and they able to confront their suppositions.*
- *Third, constructivist teachers recognize that students must attach relevance to the curriculum. As students see relevance in their daily activities, their interest in learning grows.*
- *Fourth, constructivist teachers structure lessons around big ideas, not small bits of information. Exposing students to wholes first helps them determine the relevant parts as they refine their understandings of the wholes.*
- *Finally, constructivist teachers assess student learning in the context of daily classroom investigations, not as separate events. Students demonstrate their knowledge every day in a variety of ways. Defining understanding as only that which is capable of being measured by paper-and-pencil assessments administered under strict security perpetuates false and counterproductive myths about academia, intelligence, creativity, accountability, and knowledge."*

Marrying constructivist notions with our understanding of cognitive theories should result in a "best of both worlds" scenario as constructivism supplies the broad environmental landscape (pedagogy) and the cognitive sciences provide the science (epistemology) that underpins the learning, and directs the teaching processes. In clearly defining that we wish to deliver the very best teaching **and** learning in our schools we are in a much better position to induct into our communities citizens that have a set of competencies that are far better aligned to 21st-century demands.

A reminder here: Any teaching and learning philosophy that does not take into account the nature of what it is to be human: that we are irrational, passionate and silly people rather than the often assumed (in educational theory) logical, sensible and rational, is based on a false set of premises. There is nothing wrong with being logical, sensible and rational and

¹ Unbelievable URL here!

http://www.ascd.org/portal/site/ascd/template.MAXIMIZE/menuitem.459dee008f99653fb85516f762108a0c/?javax.portlet.tpst=d5b9c0fa1a493266805516f762108a0c_ws_MX&javax.portlet.prp_d5b9c0fa1a493266805516f762108a0c_journaltypeheaderimage=%2FASCD%2Fimages%2Fmultifiles%2Fpublications%2Felmast.gif&javax.portlet.prp_d5b9c0fa1a493266805516f762108a0c_viewID=article_view&javax.portlet.prp_d5b9c0fa1a493266805516f762108a0c_journalmoid=e382d6e9c5eaff00VgnVCM1000003d01a8c0RCRD&javax.portlet.prp_d5b9c0fa1a493266805516f762108a0c_articlemoid=48c2d6e9c5eaff00VgnVCM1000003d01a8c0RCRD&javax.portlet.prp_d5b9c0fa1a493266805516f762108a0c_journalTypePersonalization=ASCD_EL&javax.portlet.begCacheTok=token&javax.portlet.endCacheTok=token

there are times when this is absolutely critical and to be encouraged, but the very people that fascinate us and that we enjoy to interact with are the passionate, the sometimes silly and the ones that question everything, who often appear to be somewhat irrational, continually testing the boundaries and questioning the norms!

Within this new framework we can begin to examine teaching practices that can synchronise with what we understand to be the way in which children learn best, noting that no two students learn in the same way, at the same place, across the same disciplines, with the same enthusiasm, with the same talents/giftings and with young people there is a tendency for every day to be a new day, with students bringing with them different attitudes to learning depending on a host of social, physical and emotional cycles and influences brought into the the school community from their greater familial and wider social community.

There is a global trend towards this philosophical skeleton being given some "substance" through the delivery of essential competencies within a curriculum framework. This is a significant improvement on the previous focus on key skills, broadening the concept of skill to include "contexts that include cognitive and practical skills, as well as the knowledge, attitudes, values and motivation required in a particular context" [<http://www.tki.org/nzcurriculum/docs/CompetenciesDiscussionPaper.doc>]

One of the foci of the application of essential competencies is the need to reconcile the competitive dimension of education which highlights excellence and individuality with the cooperative dimension of education that highlights equity, tolerance and social justice. These are not mutually exclusive and a range of competencies will be developed that both encourage and develop these sets of identified attributes.

Various reports have supported the implementation of essential competencies as a more balanced measure for reflecting the purpose of education. This will be discussed in more detail when we look at the main course later in this article.

While on the topic of education philosophy it is important to make mention of the global trend towards education processes being increasingly aimed at delivering "workplace skill sets". The purpose of "primary education" is not just the creation of a skilled workforce just as the purpose of the meal is not just to provide the body sustenance. Many education academics still argue that the transition from skills based education to competency based education institutionalises the "imperative of work" as being the keystone to education especially in the tertiary sector. The second education paradigm however has a far more balanced view of education, reflecting necessary lifelong skills in the context of the development of cognitive/academic capability and the necessity for skills to be developed in our young people that empower them with the capability to become competent and confident citizens in a complex world.

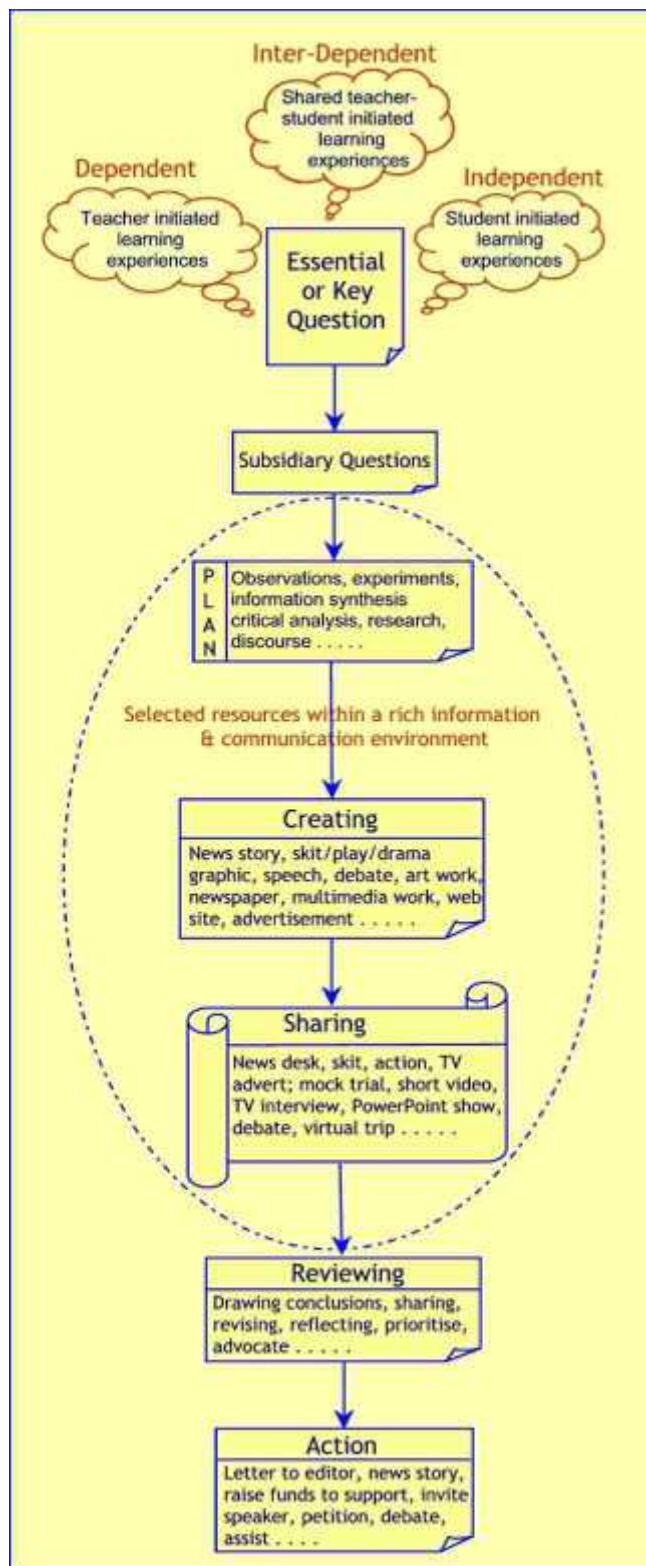
The bottom line when it comes to effective teaching and student learning is the quality of our teachers. No matter what the cost, we must encourage our best, our brightest and our most passionate to take up this mantle and inspire and encourage our young people, through a diverse and appropriate range of teaching strategies, through a curriculum that is relevant and where simplistic testing strategies are not the measure of success. . . . because the social and financial cost of not doing this greatly exceeds anything we can imagine. Disengagement with schooling is reaching epidemic proportions and is spreading virally from the large "first world" cities to the small towns of the "third world" and unless we address this urgently the social cost will be catastrophic.

The Inquiry Learning Process:

The inquiry method of teaching and learning is built on some of the principles espoused by John Dewey who asserted that children are natural learners and are naturally curious. From the New Zealand web site "living heritage" [<http://www.livingheritage.org.nz/started/inquirylearn.shtml>]

"Memorizing facts and information is not the most important skill in today's world. Facts change, and information is readily available – what's needed is an understanding of how to find, make sense of, and use relevant information for specific purposes."

Inquiry learning begins with an essential or key question that is: either proposed by the teacher, negotiated between the teacher and students or proposed entirely by the students themselves. Setting an essential or key question requires a good working knowledge of how to set effective, motivational questions which will open up a topic for students to explore. However, for the students to successfully answer the key question it is important to either provide or negotiate with them, a collection of subsidiary questions that will enable them to build knowledge and concepts necessary for them to answer the essential or key question from an informed position.



Once the essential or key question is set and the subsidiary questions negotiated the students will need to decide how they are going to answer this question. They could for instance, put together a strategic plan that would include the resources and processes required to gather the appropriate knowledge, and create the conceptual framework that will be required in order to answer the question. They will also need to focus on how they are going to share their newly found knowledge with others. This will in turn frame up what sort of resources they will have to create in order to share the knowledge and understanding effectively with their chosen group.

The questioning issue is one of considerable concern. Setting

- effective,
- fertile (stimulating and motivational),
- clever, high order (according to the
- Using a taxonomy to provide a range of questions such as the Modified Blooms Taxonomy [http://www.i-learnt.com/Paradigm_Questioning.html],
- connected (contextual to the student) or
- open questions (without necessarily a right or wrong answer),

is an art, and to begin with it would be desirable that the teacher set some sample questions while at the same time setting aside some class time to ensure that students build up their skills in this area.

"The ability to pose questions to understand ourselves and our world is at the heart of what it means to be human. Unfortunately, this essential human trait is distorted in many schools by an answering pedagogy: When questions arise, knowledgeable teachers ask the ignorant students questions primarily in the form of an examination." Yoram Harpaz and Adam Lefstein: **Communities of Thinking**. Go here to download this article.

<http://www.learningtolearn.sa.edu.au/Colleagues/pages/default/harpaz/>

In rich information and communication environments it is not just the resource content that is critical to the success of student research but also the capability of the student to access information through the ability to ask the right question.

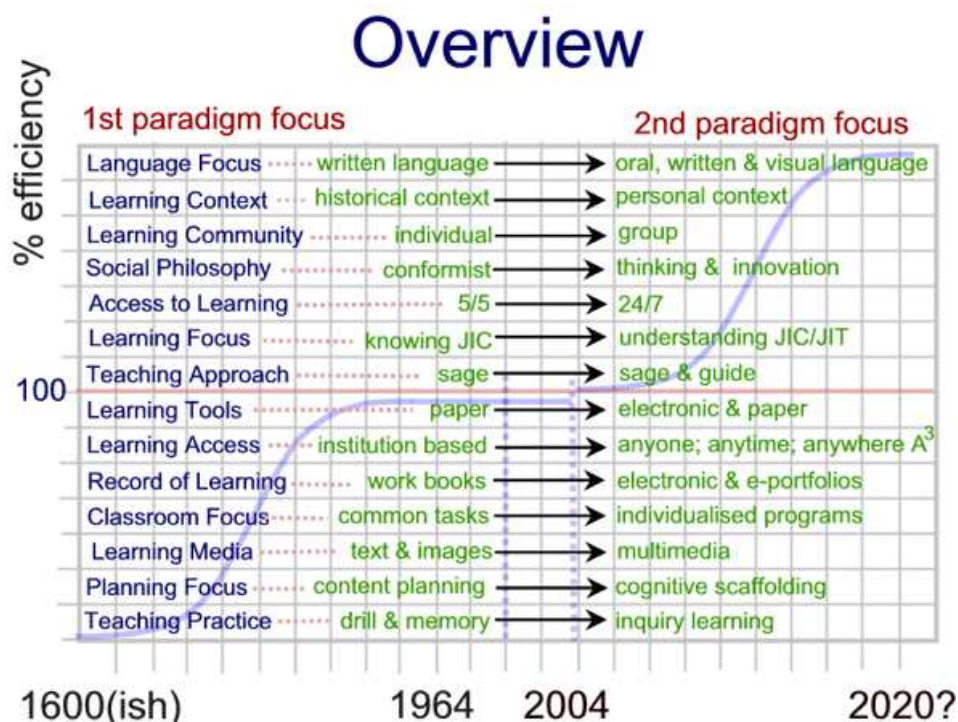
Chapter 3: The Entree

For some time now we have been discussing the advent of the second education paradigm, brought about by the transition from a world where information **and** communication systems were rare, expensive but reliable to world where the information and communication landscape has dramatically altered and where both come in a wide range of formats/genre and both are now overwhelming in number, depth and quality (with an equivalent variability in all these aspects) and as well as being cheap, they require a new raft of skills in order to be used and managed effectively. This transition has birthed the potential for many of our lifelong dreams about education to become realisable, both practically and economically.

The above paradigm shift has spawned a wide range of tangible educational transitions which were possible in the previous paradigm but unfortunately many were impractical, relying heavily on the teacher constantly re-inventing the wheel, individually creating rich content for their students to interrogate and work with. Teachers were required to create this rich content as the library was unable to resource clever, rich, open, fertile, high order thinking questions which transcended the low-level thematic topics such as space, earthquakes, the undersea world, dinosaurs musicians/mathematicians/scientists of historical consequence, . . . which could be resourced from the local library as there were 29 books on these topics in almost every school library in the world. Clever, rich, open, fertile, higher order thinking questions which encourage an education endpoint of understanding rather than just knowing, requires rich resources that make use of numerous media formats, are available 24/7 and can be manipulated simply and easily in a rich web based teaching and learning environment.

However this transition is just one of many that accompanies the adoption of the second [modern] education paradigm. Additional transitions are highlighted in the diagram below: Additional background on the adoption of the second [modern] education paradigm can be found at http://www.teachers.work.co.nz/archive_Aug_2004.htm

Diagram 3



Implementing the Changes: So how will these transitions be introduced into education when teachers are already frantically busy? 2007-2010 is a period of time that is quite frightening in its consequences. Not only will almost all schools have to implement a new curriculum but they will also have to train every staff member on how to use a completely new set of electronic tools in order for them to operate efficiently and effectively in this new paradigm. Three of those tools are:

Student Management Systems: In order to record assessment data, manage absences, record health and social details, provide timetabling support and management, provide tools for graphing and interpretation of the assessed data, demonstrate "coverage" of curriculum and as well as possibly including a library cataloguing and borrowing system. . . . Schools will require a comprehensive software package to manage all these issues.

Assessment software: A software based solution will form at least part of the process of effectively assessing student understanding of prescribed competencies. These programs are getting increasingly sophisticated and far more capable of making accurate assessments of not just explicit knowledge but also implicit applications of understanding.

Intranet, Extranet & Knowledge NET's ©: Schools began with simple in-house intranets available only to those people within the school environment and these then evolved to becoming intranets that were available from outside the classroom environment and now we have web based intranet environments which can publish web pages/sites very easily using WYSIWYG (What You See Is What You Get) editing tools that are embedded in the web browser. These then matured into web based environments which allowed groups of schools to work cooperatively together as an extranet. The final incarnation on this continuum is the Knowledge NET© [<http://www.knowledge-networks.co.nz>]. The Knowledge NET© is a resource rich personal intranet for every student and every staff member as well as an integrated Internet web site fed content directly from material placed online by the users.

The Knowledge NET© also hosts the extranet which allows the cluster of (5-10) schools to share subjects in a remote learning management environment. The Knowledge NET© also has embedded within it its own education search engine and library, access to Digital Learning Objects and easy access to common tools, encyclopaedias and newspapers so that students have a complete research centre when using any internet enabled computer (access by userID and password). The Knowledge NET© also contains an integrated electronic portfolio for the student and a professional development portfolio for each teacher. The Knowledge NET© e-portfolios contain online blogging, project planning and goal setting tools. The Knowledge NET© also contains discussion groups, chat, newsletters A completely integrated environment but once again the use of a Knowledge NET© requires professional development.

Digital learning Objects

As well as the software tools described above there is another resource that is quietly being built around the world that will allow teachers to make use of resources built specifically for use in intranets/Knowledge NET© 's. These web based resources are known as Digital learning Objects. Increasingly Digital Learning Objects are being created in a web format and stored on databases that are being made available to schools throughout the world. At the extreme end of this continuum is the DLO's being created by the Massachusetts Institute of Technology; entire courses! The Massachusetts Institute of Technology was one of the first of the major institutions to provide completely free online courses. MIT has available on a web site [<http://ocw.mit.edu/index.html>] hundreds of broad- range online courses that are free to access for anyone, anywhere, anytime. There are 600 courses available online and there are more to come. The potential this offers "students" around the world is enormous. In the

United Kingdom the Open Knowledge Initiative, a collaboration amongst the leading universities, is putting online an "open source extensible architecture" that specifies how components and educational software environments communicate with each other. Other "object repository management systems" are being offered such as Fedora [<http://www.fedora.info>] which can be used to create interoperable web based digital libraries, institutional repositories and information management systems.

At the other end of the DLO continuum is a picture library [Free Foto <http://www.freefoto.com>] or a collection of science questions [NZCER Resource banks <http://arb.nzcer.org.nz/nzcer3/nzcer.htm>] or a unit of work on Shakespeare's genre [Fathom <http://www.fathom.com/course/21701729/index.html>] or a collection of ICT training modules [Kidzonline <http://www.kidzonline.com/TechTraining/>] . . . the number of DLO's available is enormous, already there are millions.

The idea of Digital Learning Objects is that you combine them together in a sequence to create a unit of work or lesson plan. The introduction may come from one DLO library, the animations from another, the questions from another, the background reading from yet another and the extension activities from another location again. This is where WYSIWYG based intranets/Knowledge NET's © come into their own as they allow educators to "drag and drop" or "cut and paste" DLO objects from their original online location into these environments, edit them if necessary (if allowed under the "conditions of use") and then publish them on the internet for students to access without any knowledge of HTML coding whatsoever. Students can also place their work online using the same approach. **These totally web based environments are quickly replacing "office software" as the standard process for publishing.** Compiling content is now very straightforward process allowing teachers to spend more time on the process of the conceptual scaffolding that underpins the unit of work.

Each collection of DLO's comes with its own "rights of use" which describes how educators may use these objects. Some collections allow teachers to use the objects within that collection in any way they wish, editing them and manipulating them as they desire. Other collections have specific copyright conditions associated with their use. Most DLO repositories have the "conditions of use" link at the bottom of their web page. Copyright is a major issue and with the advent of WYSIWYG editors and Knowledge NET's © as these tools allow teachers to simply cut and paste web based objects into these environments.

It would be reasonable to assume that the prolific supply of online units of work, DLO's (Digital Learning Objects) and online resources in general will initiate the metamorphosis of the teachers focus from information/unit creation to the development of clever questioning strategies that encourages students to **interrogate** the supplied resources in such a way that they are able to build conceptual frameworks of understanding. The subsequent learning experiences will hopefully lead to an understanding of the knowledge, as well as ensuring its retention.

Some of the most interesting work in creating learning objects is happening at the K-12 level. The initiative by the Australian and New Zealand governments under the auspices of the Learning Federation [<http://www.thelearningfederation.edu.au>] is backed by a \$60 million budget to develop online interactive curriculum content specifically for Australian and New Zealand schools. To quote the web site the aim here is to ensure that "*The systems will also facilitate the breakdown of content into discrete 'objects' and the reassembly and repurposing of these to suit the particular needs of teachers and students.*"

The concept of learning objects involves the creation of discrete items that are described by metadata (an image of a fire engine would include the metadata creation date, author's name, keywords, curriculum areas that this might be associated with). There is obviously quite a range of descriptors that can be applied to each learning object, and so several standards have been developed, the one most institutions seem to be using being referred to as "Dublin Core" [<http://www.dublincore.org/>]. This project and many more like it around the

world are building up huge repositories of web based learning objects that will be made available to teachers to create extensible learning opportunities.

As we have mentioned previously, the 21st century will be dominated by those who have an understanding as well as knowledge of, ideas and concepts. Having taught “knowing” for so long, considerable perseverance will be required to make the transition to teaching for **understanding**.

The Necessity for Lifelong Learning: The approach described above cannot be successfully established without the students learning similar teaching and learning techniques. There are several reasons for this line of thinking:

1. If students acquire the capability for asking clever and well constructed questions then they will be able to interrogate information creatively and build understanding on their own when and where the process is required; this is truly “lifelong learning”. These skills will flow through into their work and social lives, resulting in them and their work associates, friends and family acquiring a far better understanding of changes within all spheres of their world whether it be their work place, politics, new technologies, building relationships . . .
2. In order to construct meaning, students need to think about their own thinking in an extrinsic manner, (metacognition), using a form of self-directed questioning that will interrogate their own understanding. By encouraging this we can help them to better understand, refine and present concepts as well as “create” new understandings.

Effective questioning strategies need to be strategically thought through so they build on present knowledge and understanding and allow the extension of present understanding. What this means is that asking questions that assume some already developed conceptual understanding, may well limit the possible learning response if that presumed preliminary conceptual understanding is not established and processed sufficiently to be applied in a (possibly) different context. The challenge to teachers then is to begin to build **concept scaffolding plans** that facilitate the “incremental development of increasingly sophisticated conceptual frameworks”. [http://www.teachers.work.co.nz/archive_Sept_2004.htm#Scaffolding].

The use of DLO's allows teachers to focus on scaffolding the

These three software tools will need to be interoperable and data stored on any one of these needs to be available to any other program and this will require some degree of centralised direction/management. If you couple the professional development that is required to effectively use these three software tools with the need for professional development that will be required for teachers to adopt not just a new curriculum but a whole new raft of teaching strategies alongside the 21st century understanding of how students learn most effectively, you begin to realise the scale of professional development that is going to be required of all teachers.

Professional Development: The Professional Development requirement of teachers in order to make this transition to the second paradigm is considerable (actually it is huge; on a scale of 1-10 this is a 10+!) and will require whole new infrastructures to be built in order for teachers to upskill efficiently and effectively and in a manner that is both realistic for the teacher and scalable economically.

It is important for teachers to have an overarching philosophical framework for teaching **and** learning as described above that is in keeping with the shift to the second education paradigm before we start the micro-upskilling of teachers in the transitions outlined in the diagram above (there are many other transitions not included in **diagram 3**). There has been a tendency in the past to develop teacher capability in a variety of the micro-pedagogical areas without an overarching philosophical framework and because of this approach it becomes almost inevitable that we end up with teachers receiving philosophically quite contradictory (at worst) and incompatible (at best), teaching and learning instruction during the process of their upskilling.

There has been a recent global trend towards schools and individual teachers managing their own professional development program and while this sounds attractive, teachers may/do tend to choose professional development in areas they are already competent in rather than those areas that require remediation. At the same time it is important to note that teachers may be blissfully unaware of their own needs while at same time equating their wants (in terms of professional development) with their needs.

*At this point I would like to insert a key point in regards the professional development of teachers: Teachers require upskilling in effective teaching **and** learning strategies but as a general rule professional development has been historically focused on assisting schools in delivering and assessing the delivery, of the schools "program". The second education paradigm has its end point a focus on understanding rather than knowing, hence the focus of any professional development should be on improving our understanding of:*

1. Learning: How do students learn, what is their cognitive capacity for learning and where are they in their learning cognitive development continuum, and which strategies best meet the capability of any given student at any given point in their learning continuum? We now know a lot more about the mind and how it manages new ideas, holds on to memories and builds conceptual frameworks, than we did previously (mostly through the fMRI scanning technology <http://www.cogneurosociety.org/content/links>). We have a huge distance to go before can say we understand what is happening in our minds and how we can best maximize that potential but we do know a lot more than we did in the 20th century. But much of what is taught to teacher graduates and also in professional development sessions for teachers in the 21st century is still based on a 20th century knowledge base.

2. Teaching: Which teaching strategies maximize what the individual student or cadre of students is capable of understanding and what information is required to be known in order for the strategies to be selected and put into practice? The key elements here are that **1.** Teachers need to be aware of the wide range of teaching strategies that are available to them. **2.** Students have available to them rich information and communication resources and **3.** Teachers are aware of effective assessment (not testing) strategies and have them in place, which then informs them quite clearly about what the student understands and at what point(s) in the learning process/continuum are in need of remediation.

Too often "teaching and learning" has come to mean a singular entity rather than two distinctly different but interlocking fields. Teaching staff need considerable upskilling in both of these two areas and the two areas, although interrelated, need to have a degree of separation so that an appropriate balance of both is delivered through professional development processes.

The required professional development needs to focus on generic **teaching and learning practices** that require considerable upskilling, not the teachers' knowledge and understanding of new content. In order to achieve this traditional professional development course attendance will simply not economically viable practical for all staff over such a wide number of upskilling areas or so a new model is required. One such possible model is described below and the purpose for its presentation is to stimulate discussion on innovative solutions to the dilemma outlined above rather than present it as **the** solution.

To manage professional development on this scale it is suggested that each school or group of schools providing student population of 800 could be offered a two-year professional development staff secondment whose role it will be to develop teaching and learning capabilities of the staff of the school(s). Their title would be "Professional Development Coordinator". This person does not have to have an understanding of each curriculum area

but rather their strength will be in teaching and learning practices as this is the focus of the professional development required.

Each of the three software tools described above should have intuitive software interfaces and it will be the conceptual framework that requires explanation rather than a technical person presenting these solutions. If it requires a technical person to make the presentation/professional development for these packages then you have chosen the wrong product! This full-time professional development person would require two months of intensive professional development themselves and also require ongoing professional development for one day in five for the period of their two-year secondment. Following this two-year period a new secondment is taken on for this role, expanding the knowledge base within each school or group of schools.

The professional development coordinator would also sit in on classes and provide suggestions and insights into how an individual staff member can improve their teaching practices as well as providing professional development sessions on effective teaching and learning in a one-to-many environment. The qualities of the professional development coordinator would be considerable but above all this person needs to be passionate and be someone that the teaching fraternity will trust implicitly in a supportive peer-to-peer capacity.

This one-to-one and one-to-many professional development process program would be augmented with online national professional development opportunities. This would take the form of electronic professional development and would make use of the WYSIWYG interfaces and rich digital learning objects in order to ensure that the quality of instruction was at the highest level. This would also assist in modeling the teaching and learning that would be expected of the teachers themselves. Software packages such as Macromedia's product "Breeze" has huge application possibilities due to its capability for streaming simple video as well as presenting interactive multi-user workspaces and providing inbuilt "chat" communication tools.

This integrated online and face-to-face professional development program is an expensive option; but what would be more expensive would be to develop an entirely new curriculum and integrate all these software tools, requiring a whole new range of skill sets for teachers and then not provide appropriate professional development for the teachers to make maximum use of these resources and subsequently provide their students with a truly 21st century education.

Chapter 4: The Main Course

That there needs to be a cohesive and well thought out central curriculum is without doubt but unfortunately there is a tendency for teachers to focus on the content of such documents rather than the conceptual ideals that underpins the document. As a teaching fraternity we need to face up to a major obstacle here: to quote Jacqueline Grennon Brooks in a recent article entitled "To See Beyond the Lesson" ²

"Teaching is a complicated process and it is imperative that we stop trying to make it appear simple. Many teachers readily acknowledge that for a variety of reasons they engaged in little meaning making with their students. Many acknowledge that they engage in little learning for meaning when they were students. Consequently, few teachers have actually had the experience as students of discerning patterns among ideas, generating unifying principles, or identifying similarities and differences among events. Few teachers are able to imagine how such classrooms could operate. "This is really great," they say, "and I'd love to teach this way, but we have to cover the curriculum."

Historically the focus of most curriculum documents has been the content they contain. In teaching parlance it is not "location, location, location!" but rather it is the "content, content, content" that really matters and the primary reason for this is that this was how teachers were taught themselves. In social service programs a lot of effort goes on to "breaking the cycle of violence". The understanding here is that the very people who are the victims of violence have a tendency to becoming people who victimise others violently. The same applies to teaching. We tend to teach in the manner in which we were taught, even though we know that our learning experiences were possibly very poor ones. This is a hard cycle to break. This change in teacher culture is something we urgently need to get our heads around, otherwise any new curriculum that is instigated and which does not contain a very prescribed curriculum (in order to meet the needs of the 21st Century learner by definition the curriculum will not focus on delivering content), will have the previous curriculum content simply assumed and inserted where teachers think appropriate.

The other stakeholder that requires a severe marketing make-over in this regard is the parents/caregivers. Many schools which have moved into areas such as teaching thinking, developing learning attitudes, and lifelong thinking skills have been caned by parents/caregivers as having no regard for "standards" and there have been a multitude of Chicken Little's racing around proclaiming that the sky is falling (standards are falling) because Johnny does not know the capital of Venezuela and Mary cannot divide two fractions as a piece of mental arithmetic. The notion that this bit of information can be discovered by anyone who can spell the word "Google" (should they need to know) or that dividing two fractions is a completely useless process, (both practically, cognitively or as part of a developmental process), is a real stretch for the parent/caregiver community, along with most politicians. This of course comes from the same group of people who readily admit that

² Another rather long URL from ASCD

http://www.ascd.org/portal/site/ascd/template.MAXIMIZE/menuitem.459dee008f99653fb85516f762108a0c/?javax.portlet.tpst=d5b9c0fa1a493266805516f762108a0c_ws_MX&javax.portlet.prp_d5b9c0fa1a493266805516f762108a0c_journaltypeheaderimage=%2FASCD%2Fimages%2Fmultifiles%2Fpublications%2Felmast.gif&javax.portlet.prp_d5b9c0fa1a493266805516f762108a0c_viewID=article_view&javax.portlet.prp_d5b9c0fa1a493266805516f762108a0c_journalmoid=c570bf8f07eaff00VgnVCM1000003d01a8c0RCRD&javax.portlet.prp_d5b9c0fa1a493266805516f762108a0c_articlemoid=cb90bf8f07eaff00VgnVCM1000003d01a8c0RCRD&javax.portlet.prp_d5b9c0fa1a493266805516f762108a0c_journalTypePersonalization=ASCD_EL&javax.portlet.begCacheTok=token&javax.portlet.endCacheTok=token

their education experiences were woefully inadequate and the many were bored rigid through the whole process.

An important note should be made here that this is not a reductionist policy where the only things that are taught are things that have life-skill applications. There is joy in coming to a point where the learner understands a new concept, idea or philosophy and experiences the "a-haaa" moment and even if that concept, idea or philosophy has no practical application whatsoever, it can be validated through the fact the process and underlying euphoria of discovering a new concept has been experienced. The motivation for pure research is not eh glory or and financial benefits but rather it is the a-haaa moment which is a very pleasurable one. So as usual is all about balance in the delivery of and deciding what competencies students require to be effective 21st century citizens.

Balanced against this is the realisation that it is simply not possible or desirable to deliver the historical syllabus that so many parents/caregivers expect of their local school. This is not possible or desirable for three fundamental reasons:

1. Given that our end point has now migrated from knowledge to understanding and that teachers will need to set clever, higher order, open, rich, fertile questions along with the questioning strategies that assist in the development of fundamental knowledge, the idea of doing "space" in three weeks as a science unit simply evaporates. If the 21st century teacher sets thematic topics for students such as space, dinosaurs, weather, travel, heroes, volcanoes, mathematicians from history, village life, earthquakes, the undersea world . . . There is a greater than even chance that the student will simply pay \$2.99 and download the necessary project from School Sux [www.schoolsux.com] or some similar easily accessed database of online school projects.

2. In order to teach a unit of work with the opening question

"compare and contrast the development of life on earth with that on Mars by identifying three similarities and three differences between the features of the planets. Using one of these differences use it to develop a hypothesis as to why you think life on earth has developed so prolifically while life on Mars seems nonexistent".

The teacher needs to provide rich resources in order that the student can carry out significant investigation and research and cannot simply download or copy and paste the answer or project from a single source. The upshot of this is that the amount of work perceived to have been "covered" will be significantly less than that apparently learnt through doing a study on "the solar system ". Asking clever, rich, fertile or open questions means a much more focused approach to content and teaching will involve the perception of delivering less but rather than surface knowledge what is taught will have more depth and a focus on understanding.

3. There are increasing demands on schools to deliver a wide range of new skill sets (such as information and communication technology skills, a wider range of literacy capability, project/time management, "keeping ourselves safe", . . .), an increasing amount of time carrying out what can be best described as "social welfare" work (working more closely with the parent/caregiver, ensuring appropriate care at home, sporting/cultural commitments), additional time teaching "critical thinking skills", more thorough assessment of students. And this is just the tip of the iceberg.

How is it even remotely possible to deliver all of these new expectations, teach more creatively using a broad range of questioning strategies and rich resources, and still deliver the same amount of baseline content? It is simply impossible!

But we must communicate these changes to the communities that we service and not just assume they are aware of these things through some form of osmotic process. Marketing to our communities the changes embedded in the emerging new paradigm of what "school" is,

is absolutely critical, otherwise the teaching fraternity will face a barrage of criticism from thousands of "Chicken Little's".

Given the purpose of education outlined earlier what sort of curriculum would meet this purpose and the needs of 21st century learners? The 1998 DeSeCo report released by the OECD (and unfortunately no longer available online) investigated 12 countries and their education systems in an attempt to identify and possibly define essential or core competencies that were generic for all citizens. This report initiated a series of follow-on reports by various agencies, in particular the research work of the Programme for International Student Assessment PISA study entitled "Learning for Tomorrow's World" [http://www.pisa.oecd.org/document/55/0,2340,en_32252351_32236173_33917303_1_1_1_1,00.html] with as well as Information Network on Education in Europe (Eurydice) paper entitled "Key Competencies: A Developing Concept in General Compulsory Education" [<http://www.eurydice.org/Documents/survey5/en/FrameSet.htm>] (the introduction of this report pp11-25 is particularly valuable). These reports then lead to a draft set of defined competencies that **could** more suitably underpin **at least part** of the purpose of education. Returning to the metaphor of the dinner party it is important to remember that a dinner party is not just about gaining sustenance but alongside this it is a social occasion and one which would hopefully encourage greater understanding via wide range of discourse and presentation(s) and through modelling and teaching encourage acceptable social behaviours and responsibilities common to responsible citizens and effective communities.

Two antipodean sets of competencies that are in the discussion phase have been released by Australian and New Zealand governments. The Victorian Department of Education (Vocational Education & Training) highlights seven generic competencies [<http://www.sofweb.vic.edu.au/voced/ented/keycomp/what.htm>] that people would require for effective participation **in the workforce** and they have listed these as:

- **Using Information:** the capacity to locate information, sift and sort information in order to select what is required and present it in a useful way, and evaluate both information itself and the methods used to obtain it.
- **Communicating Ideas:** the capacity to communicate effectively with others using a range of spoken, written, graphic and of other non-verbal means of expression.
- **Planning & Organising:** the capacity to plan and organise one's own work activities, including making good use of time and resources, sorting and priorities and monitoring one's own performance.
- **Working in Teams:** the capacity to interact effectively with other people both on a 121 basis and in groups, including understanding and responding to the needs of clients and working effectively as a member of the team to achieve a shared goal.
- **Using Mathematics:** the capacity to use mathematical ideas, such as number and space, and techniques, such as estimation and approximation, for practical purposes.
- **Solving Problems:** the capacity to apply problem solving strategies in purposeful ways, both in situations where the problem and the design solution are clearly evident and in situations requiring critical thinking and a creative approach to achieve an outcome.
- **Using Technology:** the capacity to apply technology, combining the physical and sensory skills needed to operate equipment with the understanding of scientific and technological principles needed to explore and adapt systems.

A proposed framework of essential competencies being investigated for the New Zealand compulsory education (year 0-13/k-12) sector by the Ministry of Education there [<http://www.tki.org/r/nzcurriculum/docs/CompetenciesDiscussionPaper.doc>] includes the following five essential competencies groups coupled with three attitudinal competencies.

- **Thinking:** critically, creatively and logically
- **Relating to others**
- **Belonging, participating and contributing**
- **Managing self**
- **Making Meaning:** Multi-literacies and using language, movement, symbols and technologies

Attitudinal competencies:

- **Motivation:** including willingness and "can-do" attitude
- **Confidence:** including a view of the self as a competent learner
- **Curiosity or inquiry:** including open-mindedness

There will undoubtedly be a multitude of permutations drawn from a wide range of competencies presented and debated by governments over the next 10 years. What we can be assured of is that literacy and numeracy will still feature within any set of competencies, however our concept of literacy will have to expand considerably to include a wide number of literacies [http://www.i-learnt.com/Information_New_Literacies.html] in order to be a lifelong learner. Our concept of numeracy capability will also need considerable revision and reflection.

Many substantive issues flow directly from the advent of the second paradigm (these have been documented earlier in this article), and the above competencies will become interwoven with the changes in teaching and learning practices that flow from the advent of the second paradigm.

Chapter 5: Dessert

In order to deliver this rich information and communication environment it is necessary for every classroom to have access to infrastructure software, application software, curriculum based software as well as an effective hardware and cabling infrastructure.

Infrastructure Software & Standards: a brief list of the essential infrastructure software tools and standards that schools now require can be quite overwhelming.

- Nationally delivered (not necessarily free) high speed filtered internet service within an educational VPN environment that function within Quality of Service (QoS) guarantees.
- Published standards for Infrastructure hardware (cabling/routers et all)
- Published Interoperability standards (such as the Schools Interoperability Framework)
- Student Management System (SMS) software (including truancy management)
- Assessment software
- Remotely hosted (ASP) internet/intranet/extranet/Knowledge NET®
- Library and resource software
- Web based browser: Mozilla, Firefox, Internet Explorer, Netscape . . .
- Access to Digital learning Objects (DLO's) via the intranet/Knowledge NET®

The necessity for schools to have access to high speed internet is now beyond doubt. High-speed Broadband Internet access must be both available and affordable for learning institutions, homes and mobile environments. Broadband/ High-speed access is defined as being greater than 0.5Mb/sec (guaranteed). To meet these requirements high-speed coverage will be achieved via a combination of satellite, DSL, cable and wireless. Where necessary this will require the unbundling of monopolistic telecommunication providers via government intervention. To deliver this there are some infrastructural requirements such as

1. Authentication should be managed by the centralised Ministry/Department of Education via an **LDAP authentication server** which provides access to recognised services via a single password and username. Services that could be supplied in this manner include access to a school's Knowledge Net management and assessment software, ministry/department of education information, libraries of Digital Learning Objects bought under licence for teacher access
2. The **Quality of Service (QoS)** provided by all recognised suppliers must meet quality standards set by the ministry/department of education. These "quality of service standards" should be published and made publicly available so that any software developed meets the required standards for interoperability. It may be that auditing of this will be necessary.
3. Schools will all be part of a **Virtual Private Network (VPN)**, allowing filtered and controlled Internet access and a safe, secure (firewalled) environment where every user can be tracked, if and when necessary. The Virtual Private Network environment will allow for free exchange of information and material (including rich data transmission), from any point to any other point within that environment,. The Virtual Private Network will be governed by standards set by the Ministry/Department of Education.

What is more, these tools must function under interoperability standards so that data only needs to be entered once into one of these software platforms (usually this will be the Student Management System) and this software exports a "flat data file" to the web that allows the other packages to update their data sets from.

It is also important that the interface that teachers interact with for each of these packages is intuitive, web based and available 24/7. Authentication, providing levels of access to each of these tools, should be via a single userID and password or alternatively via biometric

(fingerprint/Iris scanning, facial recognition . . .) analysis which will provide a portal gateway to all necessary resources and tools that the user requires.

In order to accomplish this it is necessary for the Ministry/Department of Education to initiate interoperability and authentication processes within their country/state/county.

On top of this it is necessary that each of the competing software products in each of the various areas described allow the dataset accompanying each learner to move with them through their lifelong learning process. At present almost every country suffers from a scenario where numerous pieces of data are collected regarding a students academic progress, competency capability, health, social welfare, sporting capability but very rarely is that data interrogated and made full use of. Often the transition from primary/elementary school through to junior high/college/high school sees almost no data whatsoever accompanying the child to the new institution. The new institution starts the teaching and learning processes "flying blind" with almost no knowledge of the capability of the students that they are working with and they set about systematically re-collecting new data over several years in order to recreate the dataset to a point where it once again provides useful and reliable information on student capability. This is a nonsense!

With the technology we have available right now each student should have a complete dataset follow them through their compulsory education and then be given to that student t host on their own intranet/Knowledge NET © when they complete their compulsory sector. It will be then up to that student as to how that dataset is used from then on.

Application Software: As well as infrastructure software there is also application software. Unfortunately much of the ICT (Information and Communication Technology) focus has been on atomistically teaching discrete elements of office software products rather than the overarching systemic architecture and teaching students to effectively query "help" menus and provide them with lifelong learning skills enabling them to adapt to continually iterating software applications. The role of office products such as Microsoft Office is reducing steadily and will continue to do so as open source products improved their capability and quality, but there is another threat to present dominance of "office software" in education.

The second element contributing to the reduction in the use of proprietary office software products is the capability for publishing to the Internet from WYSIWYG editing tools embedded in intranets/Knowledge NET's ©. With the application of XML capability within these WYSIWYG editing tools these tools will be able to carry out almost all the processes that publishing, spreadsheet, database and presentation tools are presently used for. We expect this XML capability to begin to become available within the next 12-18 months and to be established in the next 3-4 years in this product range.

Computer Hardware: Infrastructure development has been discussed already but schools were also need to investigate how to conclude the "last mile" along with deciding which hardware tools (laptops, desktops, tablets, PDAs, digital whiteboards) will best deliver and allow the manipulation of these rich information and communication toolsets as well as the application software packages.

The computer/laptop: For some time now schools have been experimenting with the use of wireless networks and now with the establishment of 56 Mb per second wireless LANs using the 802.11g standard [http://www.teachers.work.co.nz/archive_June_2004.htm] we believe that the best combination for schools for "last mile" delivery is the use of category 6 (for new installations) to individual buildings and then wireless distribution within the building. The main reason for the wireless application is a pedagogical one. Having students "tied" to pieces of cable surrounding the periphery of the room or having cables suspended from ceilings to each individual desktop or laptop (the result of which is teachers swimming around in a room of electronic kelp!) results in many students facing away from the teacher and/or each other.

To remove cables completely we need not only a wireless LAN but also lightweight laptop computers that are low-powered and have a battery life of 4-5 hours. Centrino low-power chip based laptops meet this specification and can be housed in a simple docking station so that once they are placed back in the docking station the batteries are automatically being charged.

The potential for tablet-based computing is considerable. However, at the moment this technology is too slow for many classroom applications. We believe that within the next 2-3 years this issue will be resolved and the tablet-based computing will become a realistic option. The potential advantages of the tablet are considerable and are based around the present frustration of having to input data via a keyboard. Tablet technology allows for data to be inputted in a variety of ways including handwritten script to text technology, voice to text technology, as well as the traditional text inputting via the keyboard. These technologies have come a long way in the past few years and we expect this improvement to continue.

The other major issue regarding laptop technology is whether or not every student requires one. As laptop technology has become more reliable as a tool they become a more realistic option for some situations. However, for most situations we do not recommend that each student has their own laptop. There are three main reasons for this recommendation.

- Even low-power Centrino based laptop computers are quite heavy for young (year 0-8) students to be carrying around with them all day. There is an optimal ergonomic balance between screen size and practicality of use. Reducing the screen size reduces the practicality of using computer technology and as a result making the laptops smaller and lighter compromises this requirement.
- Teachers are not technical experts and we do not wish to have their time consumed with managing the laptops that the students carry around with them. The focus must be on teaching and learning not on the technology and anything that gets in the way of this focus needs to be eliminated. Having 25 laptops in the classroom is simply asking for technical trouble!
- One of the emerging essential competencies is working together in groups, managing relationships and identification of roles within groups. Individualising the learning process by having each student being required to have their own laptop computer moves learning away from this essential competency and as such this situation should be avoided.

These three considerations leave us with the opinion that requiring each individual student to have their own laptop technology is detrimental to the overall teaching and learning outcomes that are being focused on. Schools could mount a reasonable argument for senior secondary/college students having their own portable laptop technology but for junior students the negatives seem to considerably outweigh the positives (and there is a considerable number of positive aspects).

The solution we are recommending is that each classroom is provided with one low-power Centrino chip based laptop computer for each 4-5 students in the classroom. These are stored in a docking station ensuring that they are being powered up when not being used. With this solution the laptop computers are completely wireless and can be used by groups of students effectively and efficiently within the classroom environment. There is still an issue of managing this technology and ensuring that teachers do not become the default classroom technician and this issue needs to be addressed.

As students move more and more towards the inquiry learning process and they store increasing amounts of their work online in their web based intranet/Knowledge NET® it is no longer necessary for each student to have their own individual laptops as all their information is stored on the web rather than on the hard drives of the machines that they use. Even the students web based bookmarks are stored in their Knowledge NET® ensuring that whatever computer they use they will have access to all their personal resources and research tools.

We have now reached the A³ point; where their schoolwork, personal information and research tools are available to Anyone, Anywhere, Anytime.

With the price difference between laptop technology and desktop technology falling dramatically and the performance of laptop technology equating to that of the desktop we see little advantage in purchasing desktop technology at this point in time. The other associated issue is securing your laptop technology so that it cannot leave the room without you knowing about it! There are a range of security devices that can be purchased at a reasonable cost to mitigate the possibility of theft.

Display Technology: The pedagogy underpinning this technology decision area is formed around the premise that teachers are required to be the "sage on the stage" for a reasonable amount of time as this teaching style is very efficient in transmitting information and conceptual ideas/frameworks across the large number of students in a small amount of time. It needs to be used in balance with being "the guide on the side" but being the sage is not something teachers should be embarrassed about doing but it should not feature any more than 25-30% of total time in the classroom.

As information is increasingly found in electronic formats it becomes more and more necessary for the teacher to be able to use these integrate multi-media resources within their presentations of ideas and concepts. In order to achieve this several technologies are worthy of discussion. The use of multimedia projectors has increased dramatically over the past few years for the point now when they are an essential piece of classroom equipment replacing the overhead projector as the tool of choice for teachers. Costs have reduced considerably, display technology has improved dramatically and multimedia projectors are now an essential piece of classroom technology for both the teacher and students to use as presenters and for the teacher and for students to be able to view multimedia presentations within the classroom.

Plasma and LCD screens may have their place small classroom is that cost factors and the sheer scalability of the size of multimedia presentations using a multimedia projector virtually eliminate these options for the foreseeable future.

Augmenting the use of multimedia projector technology has been the rise of "smart whiteboard" technology. Smart whiteboards are electronic whiteboard devices that allow the demonstrator/teacher (this demonstrator may also be the student), to operate software package directly from the whiteboard, add anecdotal notes to the presentation, interact with other smart whiteboards in other schools anywhere in the world and store the modified presentation in an animated format either on the local hard drive or on the intranet/Knowledge NET©.

This technology is expensive but we expect prices fall considerably as more competition comes into the market and sales volume increases significantly. It is not essential technology but it is very powerful technology that allows the presenter to fully interact with the software simply, using their finger as a mouse and this provides the user to add anecdotes to the original information. Storing the resultant combination as a JPEG image, a video clip or an animated presentation means that the enhanced digital content can be stored in the Knowledge NET environment simply and easily.

Another technology that is entering the market place is the "portable interactive tablet", not to be confused with the tablet laptop technology. The interactive tablet is generally the size of the screen part of your laptop computer and uses Bluetooth technology allowing either the teacher or the student to "write" on the plastic screen of the tablet and have whatever is written down appear on the screen/smart whiteboard via the multimedia projector. The drawback of this technology is that as you are using a plastic pen on a plastic screen you have to look at that the screen at the front of the room to see what you are writing and to make sure you are writing in the correct location. Most students seem to adapt to this reasonably easily while the teacher may take a bit longer!

The interactive tablet can be a very effective tool with younger students who may not be able to reach the height of the smart whiteboard. We have also found this to be a significant technology with secondary/college students who are less keen to be seen in front of the room providing answers, ideas and content whereas there are quite comfortable add their thoughts via the interactive tablet while staying in their seats. At present the interactive tablet technology is about 20 percent of the price of the smart whiteboard technology. At one-third the cost of tablet laptop technology they are not cheap but they do have a wide range of applications.

Chapter 6: Cheese & Port

Assessment has been the focal point of much of the professional development carried out over last 25 years and we have learnt much from this. One of the unfortunate consequences of this focus on assessment is the "paper war" that has resulted. In order to make the assessment process manageable and more meaningful for both the teacher and the learner two fundamental adaptations need to be adopted into the assessment repertoire:

1. The use of electronic assessment is starting to become a viable and pedagogically acceptable part of the assessment process (more detail below).
2. Assessment needs to be a partnership between the students metacognitive reflections, via electronic portfolio on their own learning in partnership with a teacher assessing the submitted work from the students in all three language formats (oral, visual and written).

1. There are a variety of assessment tools available, some which are very rigorous and have the possibility of providing considerable and informative data about student understanding [www.asttle.org.nz as an example] while other assessment tools provide very limited feedback on what students understand. It is imperative that we mitigate the effects of and limit the number of standardised testing as much as is possible.

As electronic assessment tools become more rigorous and provide data that is useful to both the teacher and the student, then an interesting opportunity unveils itself. If the assessment package demonstrates to the students that there is remediation work required in a particular area then, in combination with the knowledge NET© the assessment package could point the student to a series of remediation activities. The remediation activities would be built "on-the-fly" from the library of Digital Learning Objects (DLO's) embedded in the knowledge NET© to meet the individual needs of that particular learner as indicated by the assessment package. This process is in its infancy but there are pilot projects being proposed that could considerably reduce the assessment "paper war" that teachers are presently engaged in. It is important to note here that this requires very sophisticated software in order to assess understanding and not trivial memorisation.

One of the other challenges that we have as teachers in this new environment is to develop a cognitive processing taxonomy that is simple to apply and takes into account an environment where we can now teach for understanding and do so much more effectively. A taxonomy developed in the 1970s and 80s by two Australian academics: John Biggs and Kevin Collis which *"categorises mental activity by quantity and quality attributes of the activities required by students or by the observable products of student work"* (assessment tools for teaching and learning technical report #43; August 2004) may provide just such a taxonomy.

The focus of this assessment schema was on the Structure of Observed Learning Outcomes (SOLO). The AsTTle (**A**ssessment **T**ools for **T**eaching and **l**earning) assessment and reporting team in New Zealand has used the SOLO cognitive processing taxonomy in order to ensure effective coverage of both surface knowledge and deep, relational/understanding. Interestingly the AsTTle team discovered in their research that

"the majority of year 11 students defined studying or learning with surface strategies or methods (i.e., revision, re-reading, and reviewing of the year's work) and strongly agreed that learning involved building up knowledge by getting facts and information. In contrast, teachers preferred a deep view of learning, usually focused on academic, cognitive development, while at the same time, emphasising surface methods of teaching in order to prepare students for high-stakes qualification examinations or assessments (Brown: Teachers Conceptions of Assessment." [Unpublished doctoral dissertation, University of Auckland, Auckland, New Zealand].

In other words how teachers thought they taught and the way in which they desired to teach was at odds with how they actually taught and this appeared to be due to the fact that they would sacrifice their deeply held philosophical views on education in order to be seen as being successful in getting students successfully through “high-stakes” qualification examinations or assessments.

The SOLO cognitive processing taxonomy is very effective in its simplicity and we would suggest strongly that in order to provide a framework for delivering an assessment schema this replaces the Blooms or modified Blooms taxonomy currently used by many teachers. There are some issues with the Blooms taxonomy, which we will not address at this point in time, and the SOLO cognitive processing taxonomy seems to address these issues as well as simplifying our understanding of teaching for learning. As mentioned earlier surface teaching addresses knowledge whereas deep teaching addresses relationships and interconnectedness (understanding).

1. Teachers can teach/assess a knowledge element that can be described as uni-structural; where one particular knowledge element is taught or assessed such as

"The sun is approximately 150 million km distant from the earth. Approximately how far distant from the earth is the sun?"

2. A question that is knowledge-based can also be multi-structural, having more than one knowledge element within its composition such as

"The result of the earth being 150 million km distant from the sun is that the amount of heat that this provides the earth allows water to exist in three different physical states and that the dominant state that water is found in on earth is liquid. How many different states is water found on the earth and which is the most dominant of these?"

Questions that we would characterise as deep can be based around single; 1-1 relationships (relational) or multiple relationships; 1-many (extended abstract).

3. An example of relational understanding or a relational question may be:

"One benefit to human beings of the earth being 150 million km distant from the sun is that water exists primarily in its liquid form, which is essential for life as we know it. If the sun was 200million km distant from the sun and water did not exist in liquid form on earth, hypothetically what would be one adaptation or innovation be that humans could have to make to continue to live on earth?"

4. An example of the multi-relationship (1-many) extended abstract question may be:

"Design a life form, complete with basic life systems, which could exist on a planet where water did not exist in its liquid form."

We can summarise this taxonomy in the table below

	Surface	Deep
One	Uni-structural	Relational
Many	Multi-structural	Extended abstract

There are significant benefits of this simple but extensible cognitive processing taxonomy. The AsTTle team and use this in combination with some very clever software to develop a powerful assessment tool that can guide both teachers in their teaching practice and learners in their learning processes.

2. One area that is providing considerable insight into student understanding is the use of electronic portfolios. For some time now portfolios have featured as a collation of samples of student work, often with no set format or purpose. This random sample of work tells us

nothing about student progress and little about student knowledge and almost nothing about what they understand or are capable of describing.

One of the most significant and empowering assessment tools is student insight into their own learning. The capability of students to metacognitively reflect on their own learning processes is generally not something that occurs spontaneously, but rather something that students have to be awakened to, taught skills in and then it needs to be accompanied with a thinking culture that is pervasive throughout the entire school. This includes a complete new set of terminology and questioning strategies that students can use to interrogate and also describe their own learning.

Students need more than a single thinking tool in order to carry out metacognitive analysis of their own thinking (see chapter 2), they need to understand their own thinking processes, their own particular preferences when it comes to learning styles and have the language set allows them to describe what is happening in their own minds on modern cognitive understandings.

[http://www.brookes.ac.uk/schools/education/rescon/ocnef/CWSE_26_1_02lores.pdf]

Electronic portfolios have the capability to reflect this metacognitive process back to their teachers, their peers and their parents/caregivers. The ability to use e-portfolios within intranets/Knowledge NET's © [<http://www.knowledge-networks.co.nz>] to capture this reflected process provides invaluable information to not only the learner but also to the teacher who is assisting the learner in their learning journey. A well crafted electronic portfolio will contain a set of tools that encourages the student to reflect precisely and concisely on their learning, using the language they have been taught. This allows them to learn from their own reflections and insights and fine tune their own learning processes in conjunction with teacher input. This process will be augmented, through a conferencing process with the teacher, using the teacher's experience in interpreting student reflections and together these two insights provide an overall insight into how to improve the learning strategies and effectively remove any impediments to successful understanding.

The above statement is at best "noble" and of good intent but it is only possible with "buy-in" from the students. This requires a considerable degree of engagement as discussed in the introduction.

Historically teachers have dominated the assessment process but in this new model it is a partnership between the teacher and the student as the student increasingly takes ownership of their own learning. This is an essential aspect of becoming a lifelong learner.

Chapter 7: The Guest List:

Involvement of the entire learning community is critical for any successful institutionalised social process. In the past education was perceived as being the domain of the educated with the remainder of the community unable to listen to the conversation let alone eat at the same table. Even as we extend the concept of school to become a 24/7 process and where large amounts of the resource is available electronically, schools are one of the last vestiges of community for many first world countries. They bring a diverse range of people together under the one united purpose.

For this reason it is critical to involve the extended community in the learning process. Software such as the Knowledge NET© contains a range of tools that allow even the most "busy" of communities to have direct and effective communication with their local school. The capability of parents/caregivers to communicate directly with their children's teachers can assist in overcoming the fact that many busy parents/caregivers simply do not, perceive they do not have, or do not prioritise their time appropriately sufficiently to have much contact with the school their children attend. Parents and caregivers can find it difficult to attend meetings and information sessions with their children's teachers and the administrators of their local school to find how they can best support their own children through their learning processes. These new technologies are opening up new communication channels and new opportunities for discourse.

There are other less obvious advantages of involving the community in the schooling/learning process. We have already identified the fact that any successful society requires a large percentage of the community to be involved in lifelong learning processes in order to:

- be critically literate in order to make societal based decisions that will improve the social wellbeing of all strata of that society,
- make **informed** decisions at an individual level in a knowledge based society and
- develop or adapt new products and services to fuel the economy.

The "experts" in the lifelong learning process are, or should be teachers and for this reason we expect that they will become an increasingly valued resource within their communities. Lifelong learning requires each community member to appreciate teaching and learning processes, have an awareness of their own learning capabilities as well as the capability to use online information and communication tools which allow lifelong learning to become a practical reality in their lives. This in itself is a teaching and learning process and schools can become "lifelong learning hubs" for their communities, providing training in the area of lifelong learning which presents an opportunity for schools to take on a much higher profile in their communities. This can be particularly true of smaller communities.

As schooling becomes increasingly autonomous and local content becomes an increasingly important feature, it is imperative that communities have some input into what this local content could and should become. The teaching community within a school will always have a degree of autonomy in what is taught within their institution as they are the teaching and learning experts but there is a degree of communication required with the community in order that school reflects their community within their teaching program.

Chapter 8: An After Dinner Mint:

So there you have it!

What happens next depends on you, not “people in powerful positions”; you can change the way you teach tomorrow; you can open up possibilities that have never existed before for your students or you can choose to do nothing. What you do next does matter and you can make a difference. Having a sense of purpose in life is critical; it gives our lives meaning and makes the best possible use of gifts, talents and the passion we have been given. Fulfilling our purpose is a wonderful experience and the vocation and the profession of teaching is the most admirable of all as it allows the full expression of our talents and gifts and invests them in lives that will hopefully go on and make further differences that improve the lives of others we will never meet.

As teachers we plant seeds and often we never get to see what blossoms but we, as teachers, remember our teachers and for good reason; they changed our lives and you will do likewise for those in your care; just how much difference you make depends on how you see their futures. Yes teaching is a challenging vocation and profession, that is why our best and brightest; our most passionate, should teach.